Title:
Biomechanical differences between “Deadlifts” and “Good-Mornings”

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Abstract:
Introduction:
Multi-joint resistance exercises, including “Deadlifts” (DLs) and “Good-Mornings” (GMs), are commonly used for performance enhancement, prevention or rehabilitation of injuries to the musculoskeletal structures in the back and the lower limbs (Radcliffe, 2007). Despite their widespread use, the effects of different lower limb and trunk motion on the resulting loading conditions in the joints remain unknown. The aim of this study was to compare segmental kinematics and joint moments of the spine and the lower limbs between the DL and the GM strength exercises.

Methods:
The kinetics and kinematics of 13 subjects (average age 24.5±4.3y, mass 74±11kg, height 180±7cm), performing GMs and DLs exercises with an additional 25% (GMs), 25% and 50% (DLs) body weight (BW) on the barbell, were analysed. The study was approved by the Ethics committee of the ETH Zurich, Switzerland (EK 2012-N-57). Kinetic and kinematic data were captured using force plates and a 3D motion analysis system with 55 markers on leg, pelvis, shoulder and arms, 22 markers on the back and 2 markers attached to the barbell (List et al. 2013). Moments in the sagittal plane of the knee, hip and spine at level L4/L5 were derived using an inverse dynamics approach with quasi-static solution (Lorenzetti et al. 2012). The influences of the varying barbell loads and exercise types on the maximum joint angles and moments were analysed using a multiple repeated-measures ANOVA (p<0.05) with Bonferroni adjustment.

Results:
The maximal flexion angles of the knee were significantly different between the two exercises, with 5.3 ± 6.7° for GMs and 107.8 ± 22.4° and 103.4 ± 22.6° for DLs with 25% and 50% BW, respectively. Significantly smaller flexion angles were also found for the hip during GMs compared to DLs. No differences in the kinematics of the trunk between the two exercises were observed. For DLs, the resulting sagittal moment in the knee was an external flexion moment, whereas during GMs an external extension moment was present. Importantly, the sagittal knee joint moments did not increase with heavier weights on the barbell during DLs whereas higher sagittal moments were found at the hip and spinal level L4/L5. With 25% BW, DLs resulted in a lower sagittal moment at the hip compared to GMs while generating the same sagittal moment at L4/L5.

Discussion/Conclusion:
The biomechanical differences between the two exercises were mainly present in the lower limbs, with similar results for the range of motion and the flexion moments in the spine at level L4/L5. In order to prevent or rehabilitate from knee injuries, GMs may be the more suited exercises, with significantly smaller knee angles during exercise performance compared to DLs. DLs with 50% BW should be chosen to strengthen the hip throughout a large range of flexion angles, resulting in the highest sagittal moment and hip range of motion. Though, great care should be taken to ensure core stability of the trunk during DLs using additional weights due to higher loading of the spine.

References: